CLAIMS:

We claim:

1. A method for reducing oscillation of a feedback signal in a hearing aid, the method comprising the steps of:

determining a phase of a feedback signal over a feedback path of the hearing aid; and

shifting the phase of the feedback signal a predetermined amount, without modification of signal gain characteristics, to achieve a non-zero net phase of the feedback signal over the feedback path.

2. The method of Claim 1 wherein the step of determining the phase comprises:

determining the phase of the feedback signal at the time of fitting the hearing aid to a patient.

3. The method of Claim 1 wherein the step of determining the phase of the feedback signal comprises:

generating and providing a test signal to the hearing aid;

determining the phase of the test signal at a generation point of the test signal;

responsive to the test signal traversing the feedback path of the hearing aid, detecting the test signal; and

comparing the phase of the test signal at the generation point with the phase of the test signal at the detection point to determine the phase of the feedback signal over the feedback path.

4. The method of Claim 3 wherein the step of generating and providing the test signal comprises:

selecting a test signal that is substantially undetectable by the patient, from a group of possible test signals, based on the patient's hearing impairment.

5. The method of Claim 4 wherein the step of selecting the test signal comprises:

selecting the test signal from the group comprising sine waves, pseudorandom signals, white noise, and minimum excursion signals.

6. The method of Claim 3 wherein the step of shifting the phase comprises:

determining a set of filter coefficients that shift only the phase of the feedback signal; and

providing the feedback signal to a filter configured with the filter coefficients.

7. The method of Claim 6 wherein the step of determining the phase of the feedback signal comprises:

periodically determining the phase of the feedback signal during normal operation of the hearing aid; and

determining updated filter coefficients based on the periodically determined phase of the feedback signal.

8. The method of Claim 7 comprising:

monitoring the hearing aid for one of conditions favorable to oscillation and oscillation of the feedback signal;

responsive to detecting one of conditions favorable to oscillation and oscillation of the feedback signal, determining the phase of the feedback signal; and

determining the updated filter coefficients based on the determined phase of the feedback signal.

9. The method of Claim 1 wherein the step of shifting the phase of the feedback signal the predetermined amount comprises:

determining the patient's ability to detect audio queues generated by a phase shift; and

determining the predetermined amount of phase shift, based on the patient's ability to detect the audio queues, to minimize detection of the phase shift by the patient.

10. The method of Claim 9 wherein the predetermined amount of the phase shifting is in the range of 10 degrees to 350 of phase shift.

11. The method of Claim 1 wherein the step of shifting the phase of the feedback signal the predetermined amount comprises:

shifting the phase of the feedback signal to achieve a net phase over the feedback path of about 180 degrees.

12. The method of Claim 1 wherein the step of determining the phase comprises:

determining the phase of the feedback signal over a frequency range of the hearing aid.

13. The method of Claim 1 wherein the step of determining the phase comprises:

determining the phase of the feedback signal over a frequency range where a signal gain is one of; approaching one, equal to one, and greater than one.

14. A method for reducing oscillation of a feedback signal over a feedback path in a hearing aid, the method comprising the steps of:

monitoring the hearing aid for at least one of conditions favorable to oscillation of a feedback signal and oscillation of the feedback signal;

responsive to detecting one of the conditions favorable for oscillation and oscillation of the feedback signal, determining the phase of the feedback signal; and

shifting the phase of the feedback signal a predetermined amount, without modification of signal gain characteristics, to achieve a non-zero net phase of the feedback signal over the feedback path.

15. The method of Claim 14 wherein the step of determining the phase of the feedback signal comprises:

generating and providing a test signal to the hearing aid;

determining the phase of the test signal at a generation point of the test signal;

responsive to the test signal traversing the feedback path of the hearing aid, detecting the test signal; and

comparing the phase of the test signal at the generation point with the phase of the test signal at the detection point to determine the phase of the feedback signal over the feedback path.

16. The method of Claim 15 wherein the step of generating and providing the test signal comprises:

selecting a test signal that is substantially undetectable by the patient, from a group of possible test signals, based on the patient's hearing impairment.

17. The method of Claim 16 wherein the step of selecting the test signal comprises:

selecting the test signal from the group comprising sine waves, pseudorandom signals, white noise, and minimum excursion signals.

18. The method of Claim 15 wherein the step of shifting the phase comprises:

determining a set of filter coefficients that shift only the phase of the feedback signal; and

providing the feedback signal to a filter configured with the filter coefficients.

19. The method of Claim 18 wherein the step of determining the phase of the feedback signal comprises:

periodically determining the phase of the feedback signal during normal operation of the hearing aid; and

determining updated filter coefficients based on the periodically determined phase of the feedback signal.

20. The method of Claim 14 wherein the step of shifting the phase of the feedback signal the predetermined amount comprises:

determining the patient's ability to detect audio queues generated by a phase shift; and

determining the amount of phase shift, based on the patient's ability to detect the audio queues, to minimize detection of the phase shift by the patient.

21. The method of Claim 20 wherein the predetermined amount of the phase shifting is in the range of 10 degrees to 350 of phase shift.

22. The method of Claim 14 wherein the step of shifting the phase of the feedback signal the predetermined amount comprises:

shifting the phase of the feedback signal to achieve a net phase over the feedback path of about 180 degrees.

23. The method of Claim 14 wherein the step of determining the phase comprises:

determining the phase of the feedback signal over a frequency range of the hearing aid.

24. The method of Claim 14 wherein the step of determining the phase comprises:

determining the phase of the feedback signal over a frequency range where a signal gain is one of; approaching one, equal to one, and greater than one.

25. A hearing aid comprising:

a microphone to receive audio inputs and provide a response signal;

a signal processor to process the response signal to generate a transducer drive signal, wherein a portion of one of the response signal and the transducer drive signal is received over a feedback path as a feedback signal;

a transducer to utilize the transducer drive signal to stimulate a component of the auditory system;

phase shifter logic to shift the phase of the feedback signal a predetermined amount, without modification of signal gain characteristics, to achieve a non-zero net phase of the feedback signal over the feedback path.

26. The hearing aid of Claim 25 comprising:

adaptive circuitry to determine the phase of the feedback signal over the feedback path.

27. The hearing aid of Claim 26 wherein the adaptive circuitry comprises:

a signal generator to generate and provide a test signal to the hearing aid; and

phase measuring logic to determine the phase of the test signal at a generation point and responsive to the test signal traversing the feedback path of the hearing aid, compare the phase of the test signal at the generation point with the phase of the test signal at a detection point to determine the phase of the feedback signal over the feedback path.

28. The hearing aid Claim 27 wherein the test signal is selected from a group of possible test signals, based on the nature of the patient's hearing impairment, to select a test signal that is substantially undetectable by the patient.

29. The hearing aid Claim 28 wherein the test signal is selected from the group comprising sine waves, pseudorandom signals, white noise, and minimum excursion signals.

30. The hearing aid of Claim 26 wherein the phase shifter logic includes a set of filter coefficients that shift only the phase of the feedback signal.

31. The hearing aid of Claim 30 wherein the adaptive circuitry is configured to periodically determine the phase of the feedback signal during normal operation of the hearing aid and generate updated filter coefficients based on the periodically determined phase.

32. The hearing aid of Claim 27 comprising:

oscillation detection logic to monitor the hearing aid and to provide a signal to the signal generator to generate the test signal responsive to detecting one of favorable conditions for oscillation of the feedback signal and oscillation of the feedback signal.

33. The hearing aid of Claim 25 wherein the phase shifter logic is configured to shift the phase based on the patient's ability to detect audio queues generated by the phase shift to minimize the patient's detection of the phase shift.

34. The hearing aid of Claim 25 wherein the phase shifter shifts the phase in the range of 10 degrees to 350 of phase shift.

35. The hearing aid of Claim 25 wherein the phase shifter shifts the phase to achieve a net phase over the feedback path of about 180 degrees.